

Wavefront Sensing for a Segmented-Aperture Space Telescope Coronagraph

Completed Technology Project (2016 - 2017)



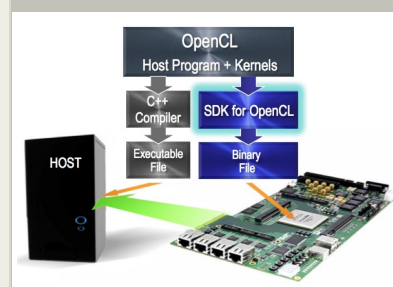
Project Introduction

Imaging terrestrial planets demands rigorous requirements on angular resolution and sensitivity. A large (> 8 meter) segmented aperture telescope can provide a solution but only if several other enabling technologies are implemented simultaneously, such as a starlight suppression system, capable of dealing with a segmented aperture. This proposal develops the wavefront sensing and control (WFSC) component of a starlight suppression system, supporting both the WFIRST and the Large-Aperture UVOIR Space Telescope (LUVOIR) architectures.

The objective of the proposal is to develop the software architecture for the wavefront sensor. We will develop the sensor in the context of controlling the dynamical disturbances of a segmented primary as configured in a coronagraphic instrument. The software and algorithms will be developed, performance simulations performed, and then tested using open-loop processing of Testbed data, for a demonstration of TRL 4 (laboratory verification). The goal is to develop a parallel implementation the Deformable Mirror (DM) update algorithms and then demonstrate high contrast in the lab, at an update rate that is traceable to on-orbit stability requirements. These results will then be converted into an FPGA design (Field Programmable Gate Array).

Anticipated Benefits

This proposal develops the wavefront sensing and control (WFSC) component of a starlight suppression system, supporting both the WFIRST and the Large-Aperture UVOIR Space Telescope (LUVOIR) architectures.



Development flow diagram

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Project Transitions

▶ **October 2016:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Terence A Doiron
Megan E Eckart
Timothy D Beach

Principal Investigator:

Bruce H Dean

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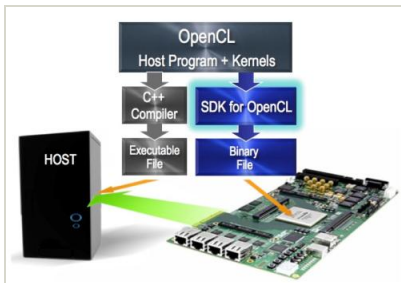
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✓ September 2017: Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services. Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry. The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies. If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. <http://techport.nasa.gov/help>

Images



Development flow diagram

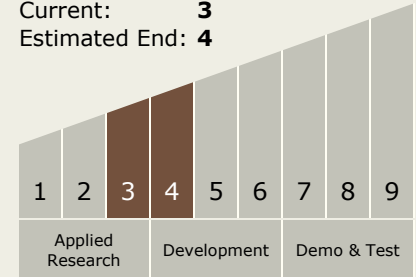
Development flow diagram
(<https://techport.nasa.gov/image/26367>)

Project Website:

<http://aetd.gsfc.nasa.gov/>

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX10 Autonomous Systems
 - └ TX10.4 Engineering and Integrity
 - └ TX10.4.5 Architecture and Design of Autonomous Systems

Target Destinations

Outside the Solar System,
Foundational Knowledge

Supported Mission

Type

Planned Mission (Pull)